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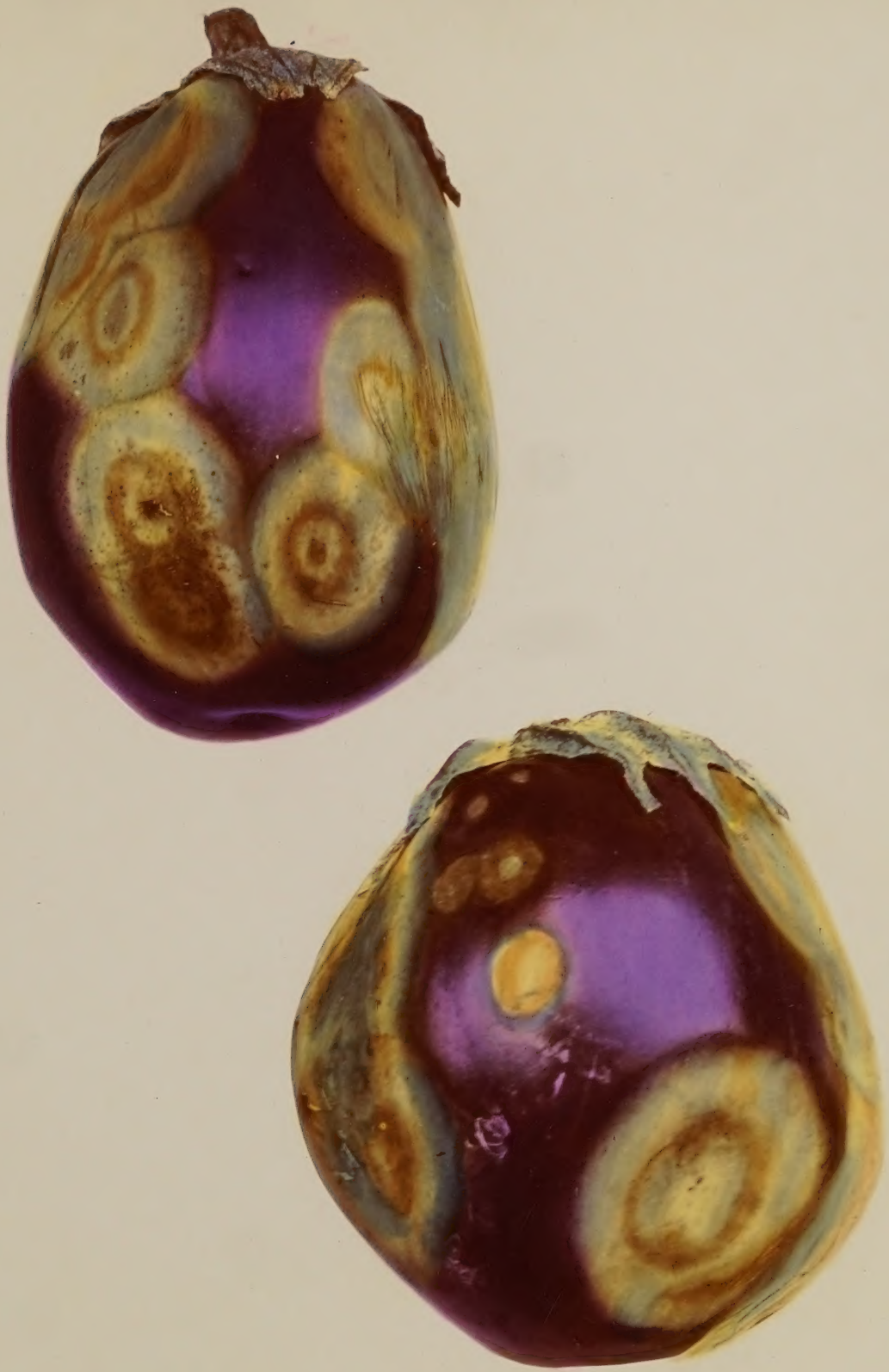


EGGPLANT — FRUIT ROT

EGG PLANT: FRUIT ROT.

Cause: A fungus (Phomopsis vexans).

At first fruit rot consists of small, circular or oval spots. Usually the lesions are at first much lighter in color (tan or gray) than the surrounding tissue. Later the lesions become dark brown and sunken, and under favorable conditions increase very rapidly in size. By the coalescence of such lesions, much or all of the surface of a fruit may be involved. Small, brown to black, pimple-like pustules or pycnidia break through the surface and cover the inner and older zones of affected tissue. The affected regions are brown and softened. At times they are quite dry, suggesting a dry rot.

Fruit rot occurs in all egg plant growing regions, but is especially severe in the South.

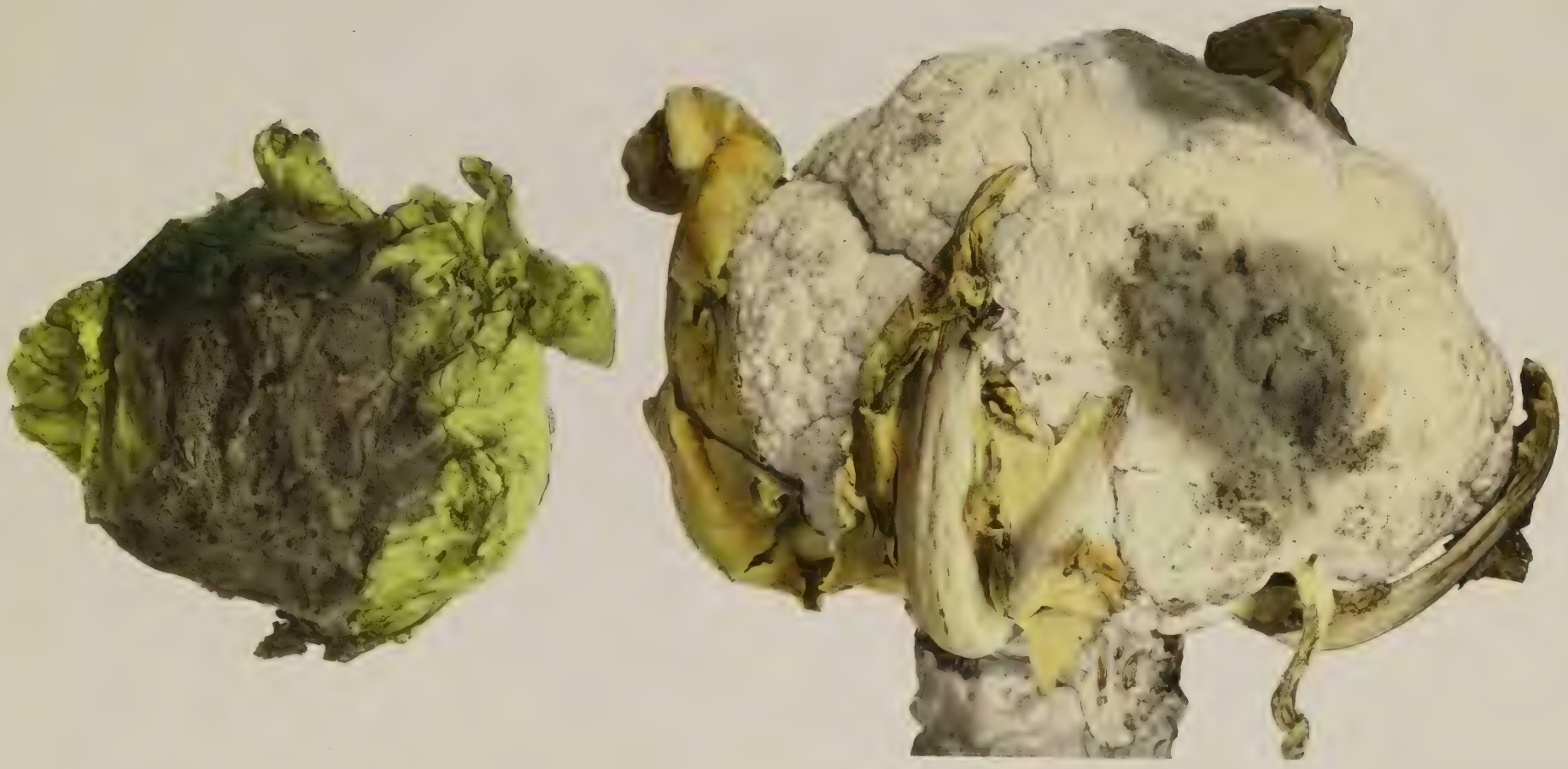
The disease occurs on the plants in the field, where it attacks leaves, stems, and fruit, and is known as leaf spot, stem blight, and fruit rot. The original infection of the fruit takes place in the field, but the disease develops and spreads in transit and often causes heavy losses.

It is not safe to ship spotted fruits.

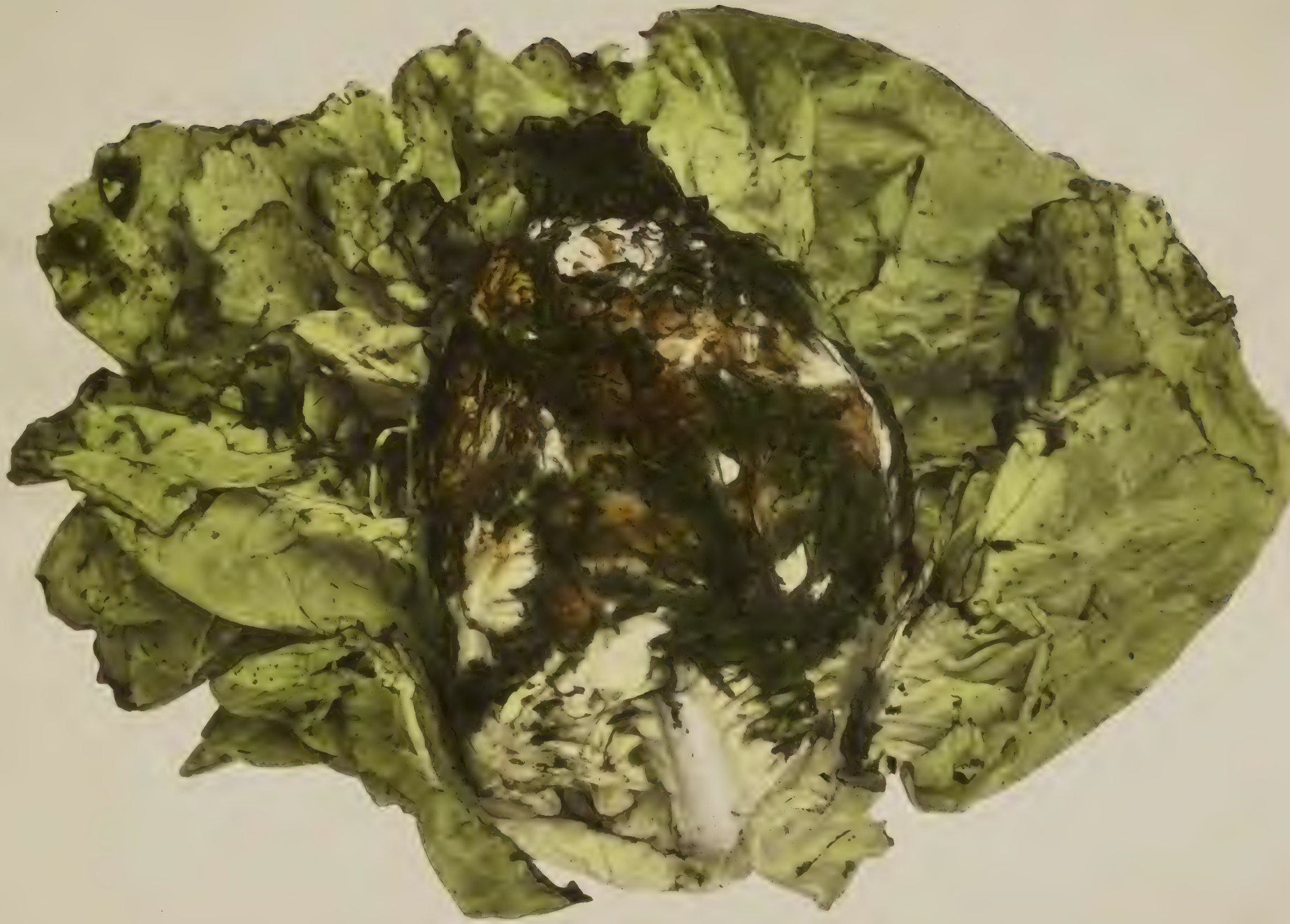
Ref. (23).

EGG PLANT: RHIZOPUS ROT.

(See Rhizopus Rot).



HEAD LETTUCE GRAY MOLD ROT CAULIFLOWER



HEAD LETTUCE SLIMY SOFT ROT.

LETTUCE: BLACK ROT.

Cause: Bacteria.

Black or brown spots or irregular patches on the outer leaves, increasing in size under proper conditions until entire leaves are involved, are the symptoms of this disease. Later the inner leaves may be attacked, and a soft dark brownish rot of the head may result.

This is a field disease reported from Florida affecting seedlings and older plants. It may develop during transit.

Other bacterial field diseases of lettuce have been reported from North Carolina and Louisiana.

The relation of these field diseases to the slimy soft rot prevalent in the market has not yet been determined.

Ref. (60).

LETTUCE: GRAY MOLD ROT; BOTRYTIS ROT.

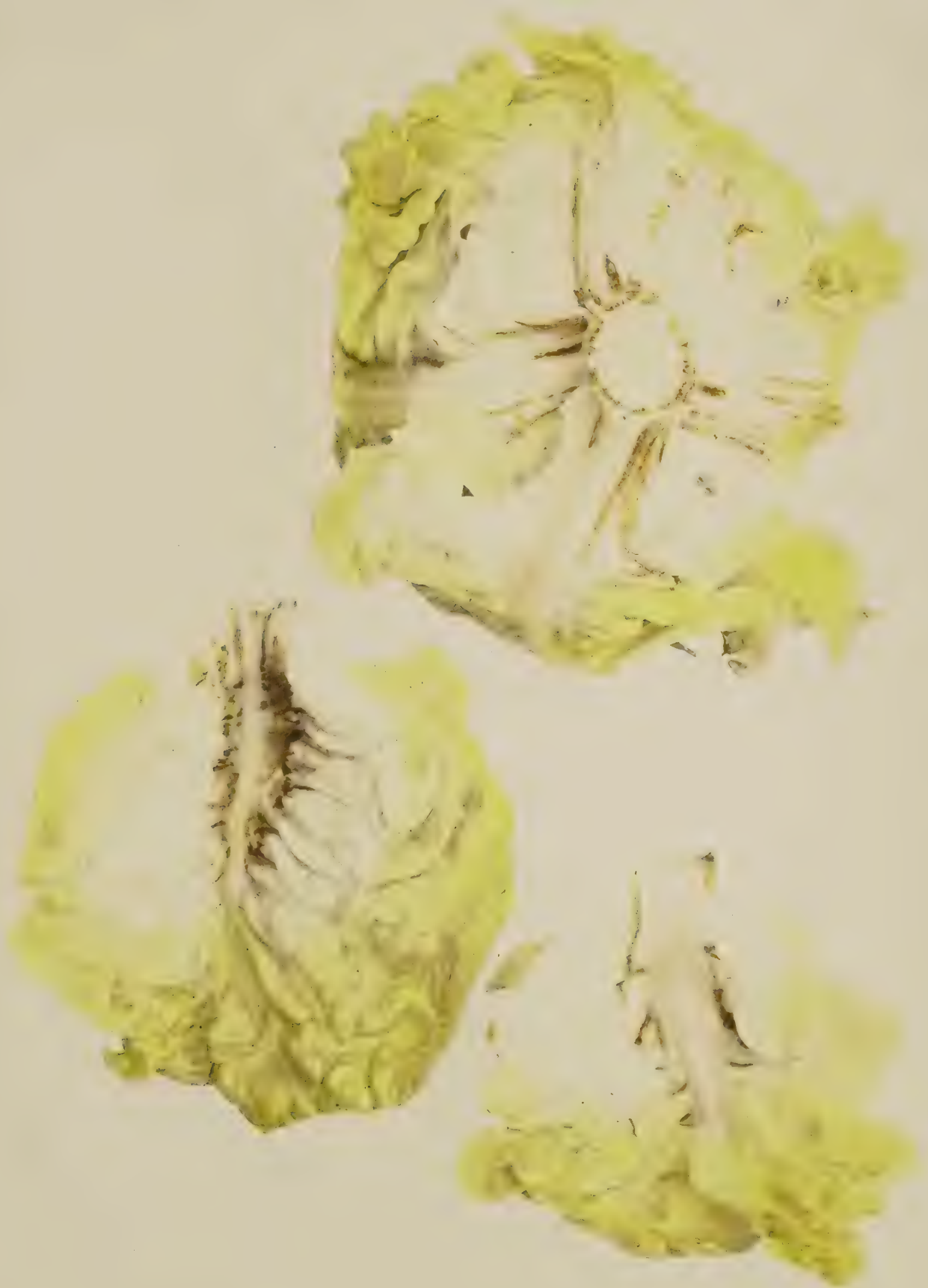
(See Gray Mold Rot and Cauliflower Gray Mold Rot).

LETTUCE, ENDIVE, ESCAROLE, AND CHICORY: SLIMY SOFT ROT; BACTERIAL ROT.

(See Slimy Soft Rot).

LETTUCE: WATERY SOFT ROT; SCLEROTINIA ROT; DROP; DAMP-OFF.

(See Watery Soft Rot).



HEAD LETTUCE - RUSSET

LETTUCE: RUSSET.

Cause: Not known, probably non-parasitic.

This disease is characterized by small reddish to russet spots or streaks which may occur on practically all of the leaves of an affected head. The brown streaks usually occur along the large veins of the leaves. The vascular bundles in the stalk and in the petioles may also be discolored.

Russet occurs in lettuce from all regions.

Nothing is known about control of the disease.

It is advisable to sort carefully before shipping because the presence of russeted heads reduces the value of a shipment.

LETTUCE TIP BURN.

LETTUCE: TIP BURN.

Cause: Non-parasitic (irregular water supply).

This disease is characterized by the dead, brown borders of the leaves throughout the head. It is found in head lettuce from all except the Boston district.

Tip burn is a field disease probably caused by an irregular water supply. The injury is most likely to occur when bright warm weather follows a period of cloudy or rainy weather, and is much worse on certain soils than on others. The disease seems to be least prevalent on a soil with a high sand and low clay content, combined with a high water-holding capacity. In such a soil, lettuce becomes deep rooted, and can apparently obtain water with sufficient rapidity to prevent injury from too rapid transpiration. In the Imperial Valley of California, this disease appears to be associated with an excess of alkali in the soil.

Tip burn often predisposes affected stock to slimy soft rot during transit and storage. The slimy soft rot starts in the dead tissues, especially in the interior of the head where moist conditions prevail. Sometimes the rot gets a foothold even in the growing plant.

No effective method of control has been established for tip burn. A well-regulated water supply and the use of varieties properly adapted to the soil and climatic conditions are important considerations.

Ref. (19); (20).

LETTUCE: MISCELLANEOUS DISEASES.

DOWNY MILDEW.

Cause: A fungus (Bremia lactucae).

The symptoms of this disease are sharply angular leaf spots, yellowish to brown when viewed from above, and bearing on the lower surfaces a white felt-like outgrowth of mold, the spores and spore-bearing mycelium of the fungus.

Downy mildew occurs on lettuce grown under glass and on the field crop where moist cool weather prevails, as in the Colma district in California. In head lettuce, the inner as well as outer leaves are attacked. This disease is of some importance because of its direct attack on the edible leaves and because of its tendency to predispose the tissues to slimy soft rot.

LEAF SPOT.

Cause: A fungus (Septoria consimilis).

This disease causes brown spots on the older leaves bearing black points, the pycnidia of the fungus. It occurs on garden varieties late in the season, and is of little importance.

LEAF SPOT.

Cause: A fungus (Cercospora lactucae).

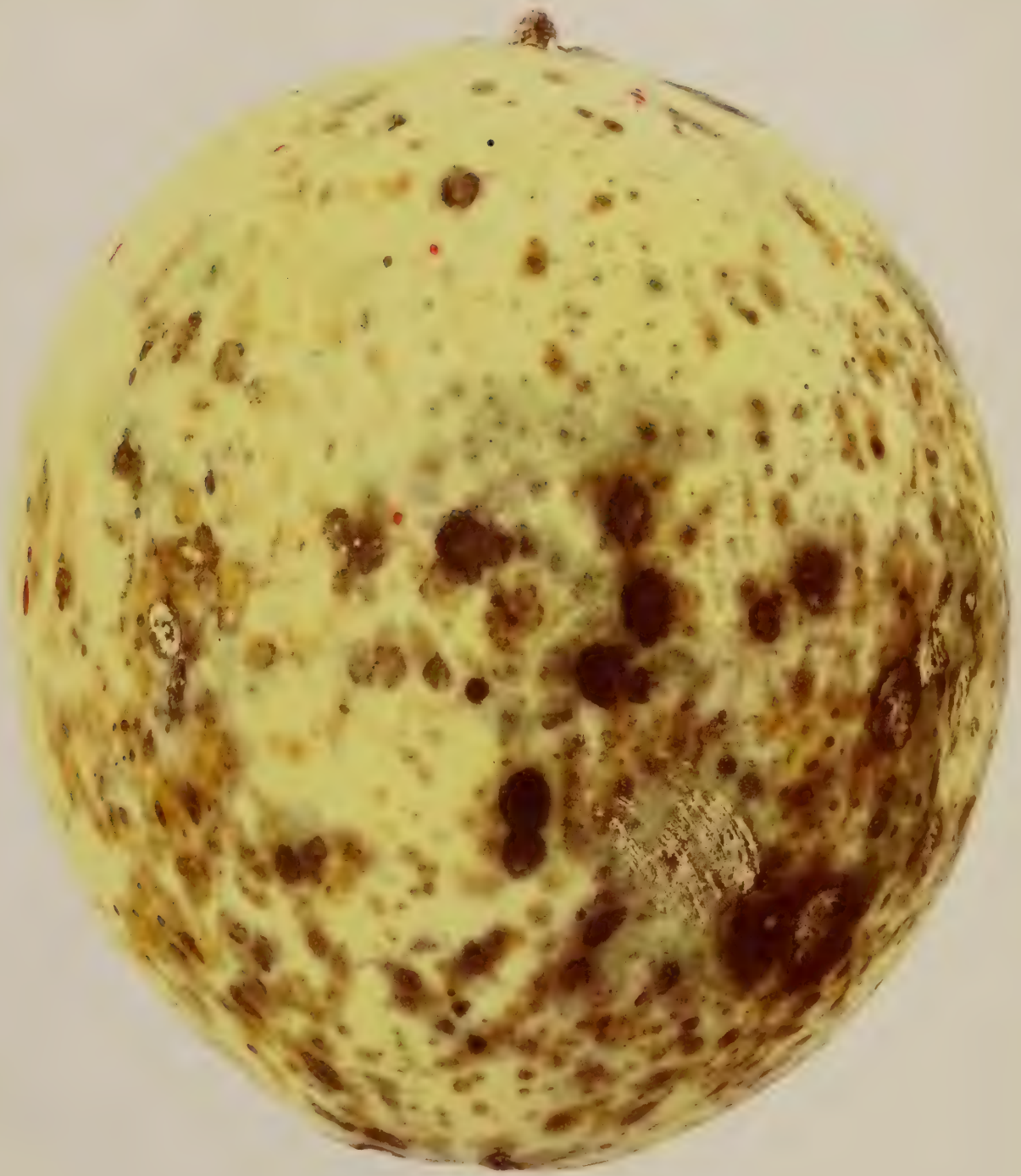
Small tan-colored spots on the older leaves are the symptoms of this disease, which has been noted in the San Francisco market.

SHOT HOLE OR ANTHRACNOSE.

Cause: A fungus (Marssonia panattoniana).

Small brown spots on the leaves, from which the dry centers often crack and fall out, are characteristic of this disease, which occurs on greenhouse lettuce.

Ref. (2).



HONEYDEW MELON FRUIT SPOT

MUSKMELON: (HONEYDEW AND CASABA): FRUIT SPOT.

Cause: A fungus (Alternaria).

On Honeydew melons, this disease appears first as small water-soaked or chestnut-brown spots on the surface. As these enlarge, they become more oval in shape and may have wide water-soaked borders. Later the lesions become more or less sunken and usually develop black centers. Under humid conditions a velvety surface growth of mold is produced on the lesions. This mold is at first gray, but soon becomes dark greenish gray and later dark brown or almost black.

Continued development and coalescence of these lesions lead to an extensive shallow rot of the rind accompanied by a cracking of the surface. The affected tissue is at first very soft and watery, later becoming yellowish and very dry, tough, and leathery. The rot eventually penetrates through the rind into the edible pulp below.

The symptoms on the Casaba melon are essentially similar to those on the Honeydew melon. On the striped Christmas Casaba melon, the lesions are brown and less conspicuous and the surface growth of mold is not common.

Fruit spot lesions differ from those of anthracnose in the absence of acervuli and in the moldy outgrowth usually present.

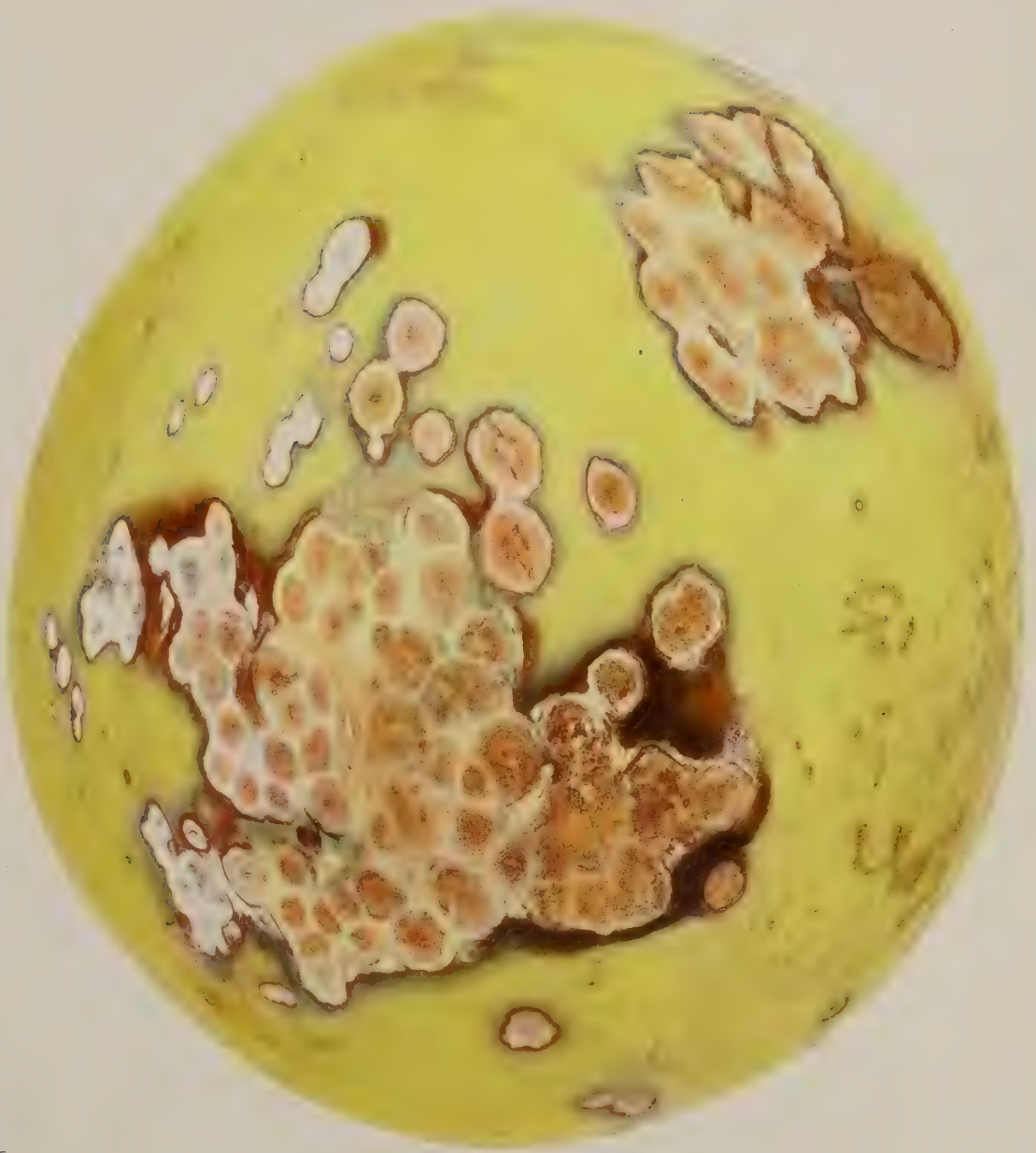
This disease was found very prevalent during the fall of 1918 on Colorado Honeydew melons, and on both the Casaba and Christmas Casaba melons from Turlock, Cal.

The source of infection is not known. The lesions appear during transit and storage and become very conspicuous in the market, not only detracting from the appearance of the melons but also causing an objectionable surface rot. In addition, the lesions also serve as points of entry for other rot-producing organisms.

No control measures are known.

MUSKMELON: SUN-SCALD.

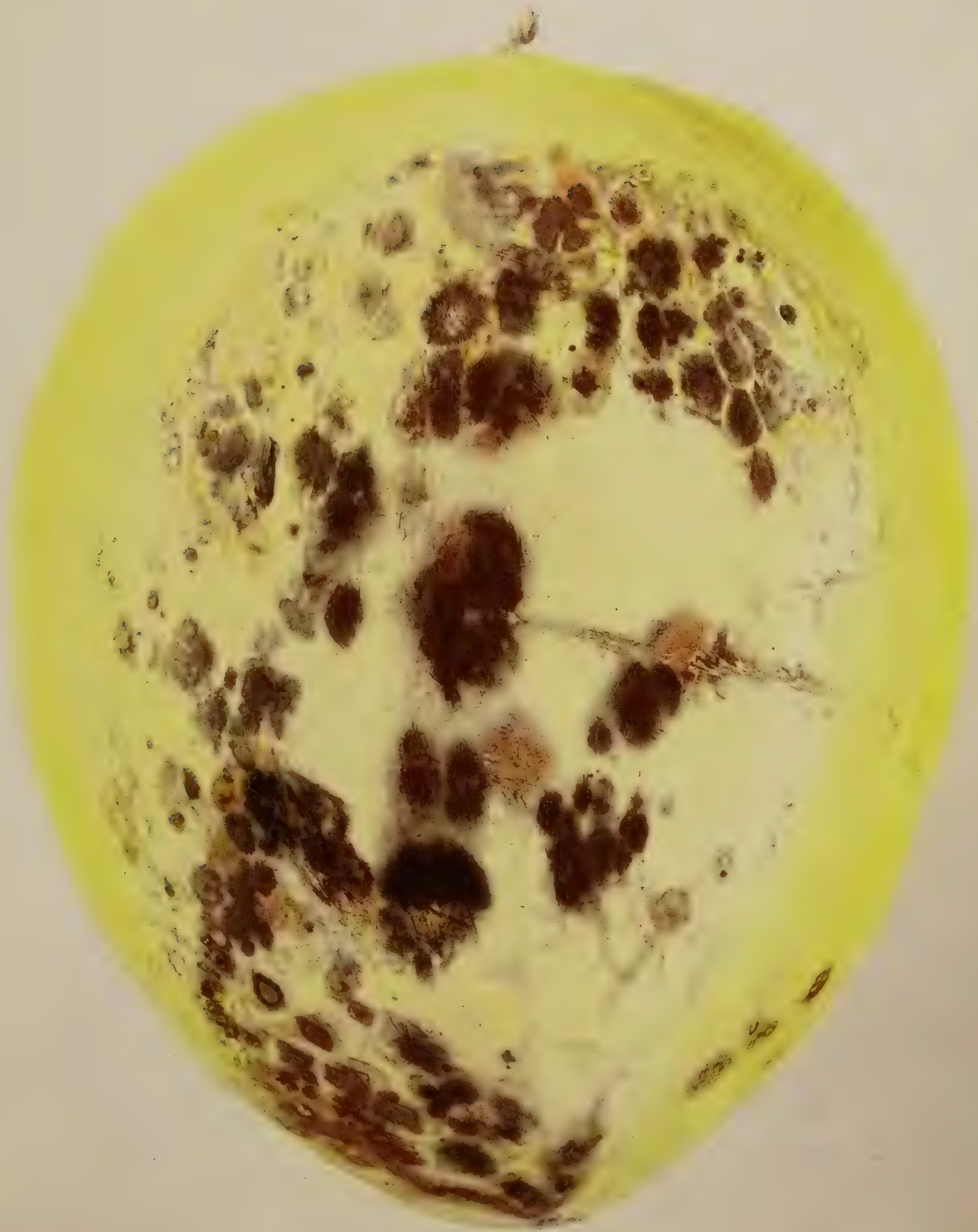
(See Sun-Scald).



MUSKMELON—ANTHRACNOSE

MUSKMELON (CANTALOUPE AND HONEYDEW): ANTHRACNOSE.

(See Cucumber Anthracnose).



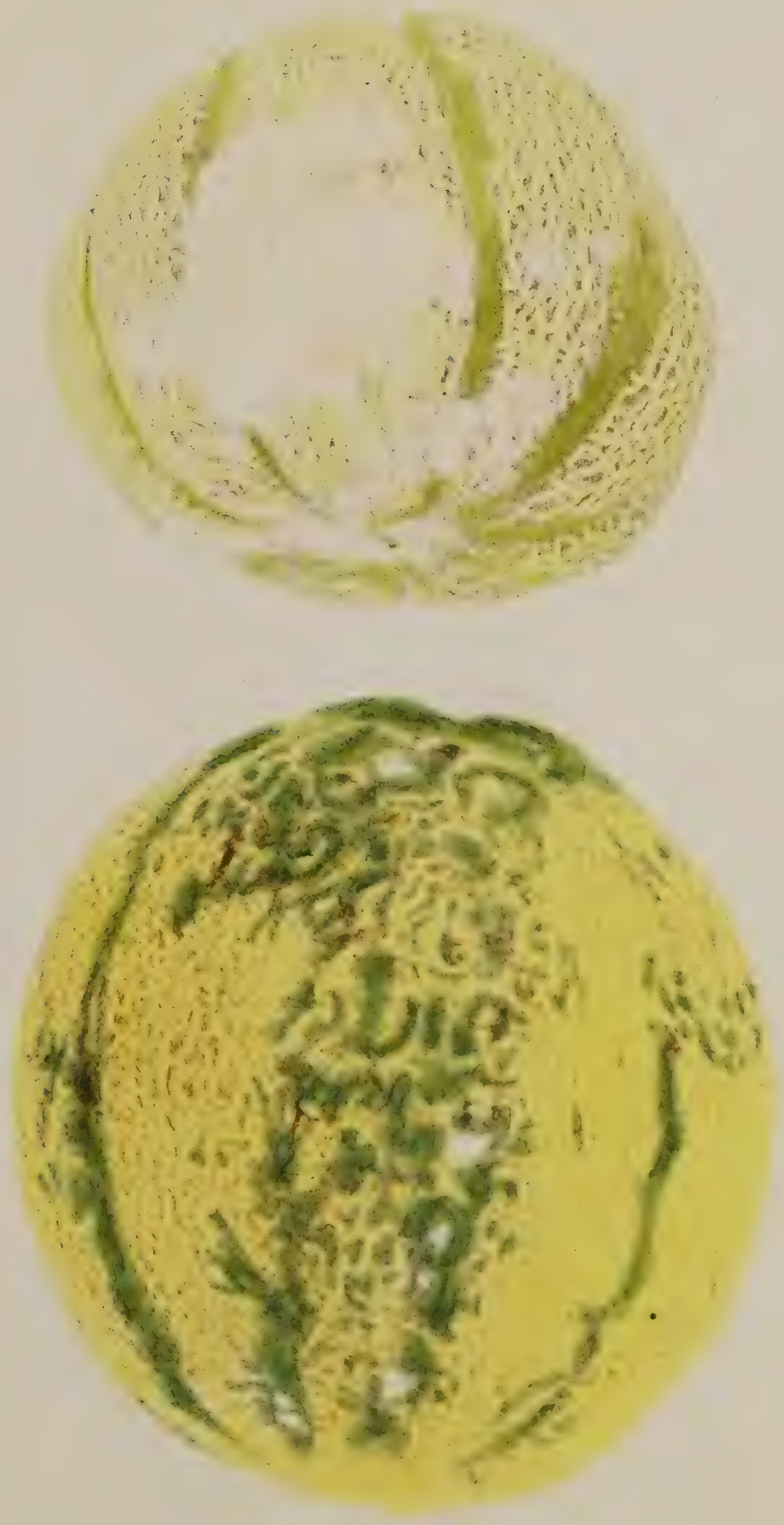
HONEY-DEW MUSKMELON BLACK MOLD.

MUSKMELON (HONEYDEW): BLACK MOLD ROT.

Cause: A fungus (Alternaria).

This is marked by a brown to black, velvety surface growth of the fungus. The fungus usually invades tissue killed by sun-scald and causes a rot of the underlying tissues. This rot is also very common on watermelons affected by sun-scald.

CASABA MELON FUSARIUM ROT



CANTALOUPE: FUSARIUM ROT
GREEN MOLD ROT (BELOW)

MUSKMELON (CANTALOUPE): MISCELLANEOUS DISEASES.

BACTERIAL SOFT ROT.

Cause: Bacteria.

Wounds and fruit spot lesions may open the way for the entrance of bacteria which cause a soft rot of the tissues. This rot is very soft and mushy and the tissue appears water-soaked.

FUSARIUM ROT.

Cause: A fungus (Fusarium).

This is a rapidly progressing rot usually characterized externally by a dense and profuse outgrowth of pinkish white mold. The rotted tissue is rather dry, and the pink mycelium may cause the entire rotted area to appear pinkish in color. Other types of Fusarium rots may occur in the field. These rots progress more rapidly than the rot caused by Alternaria.

GREEN MOLD ROT.

Cause: A fungus (Cladosporium).

This disease occurs very frequently on cantaloupes after they have been in transit a long time. It is characterized by a green, velvety fungous growth, which causes a slowly progressing rot.

ONION BLACK MOLD.

ONION: BLACK MOLD ROT.

Cause: A fungus (Sterigmatocystis niger).

Black mold is characterized by black, powdery masses on or between the scales. When these masses occur between the scales they have a tendency to follow the veins.

Affected stock may show no symptoms other than the presence of this black powder. At times sunken and discolored areas are found underlying the powdery black masses. Under dry conditions the affected tissue is papery and brittle and sometimes highly colored.

Although commonly called "smut," this disease should not be confused with true smut. The latter is rarely found on the market except on sets, and is marked by black, powdery masses within the scale tissues.

All varieties of onions are susceptible. The disease is very common on California and Texas onions. Infection occurs in the field, though the fungus continues to grow in storage.

As a rot, this disease under dry conditions usually is of minor importance, but as a blemish it causes very serious depreciation in value of the affected stock. Under moist conditions the fungus may cause severe rotting.

Since this disease does not progress very rapidly, affected bulbs can probably be held for some time if they are kept in very dry storage at 32° to 35° F., preferably in slatted crates rather than in bags.

Ref. (74).

ONION: GRAY MOLD ROT; BOTRYTIS ROT.

(See Gray Mold Rot).

ONION NECK ROT.

ONION: NECK ROT.

Cause: Fungi (Botrytis; Sclerotium).

This is a semi-watery rot followed by a shrinking and shriveling of the scales. The rot occurs typically as a neck rot in the field, while in storage other regions of the bulb also may be attacked. A gray moldy growth and hard, grayish to black masses of the fungus (sclerotia) develop on the outside of the scales. Neck rot is an example of the gray mold rot of vegetables elsewhere described.

Neck rot has a tendency to rot all scales uniformly downward rather than to follow certain scales as does slimy soft rot. Typical neck rot is especially conspicuous in white onions. In red and yellow varieties, the infection may be confined to the inner scales, and external neck rot symptoms may be lacking. In colored varieties, the soft rotted condition is often found, and the diseased flesh frequently becomes pinkish, but the gray mold growth and sclerotia are less commonly found. Unlike slimy soft rot, neck rot does not have a foul odor.

Infection takes place in the field, at or shortly after the harvest. The fungus enters the cut necks of bulbs, and gradually progresses downward. The rot develops in storage under moist conditions. Chilled or frozen onions and scallions are subject to neck rot. In chilled onions, the rot is more frequent in places other than the neck.

If onions show a high percentage of neck rot in storage, transit, or market, disposal for immediate consumption is advised.

The disease can be controlled by prompt curing of the crop and by storage in a dry place at 32° to 35° F. It is destructive in onion sets as well as in table stock.

Ref. (48).

ONION SLIMY SOFT ROT.

ONION: SLIMY SOFT ROT.

Cause: Bacteria (Bacillus carotovorus group).

This is a very soft, mushy rot of the scales, which progresses downward from the neck and is accompanied by a very repulsive odor. Often it is confined to only one or two scales in the interior of the bulb. Lesions may occur anywhere, however, especially if the tissues have been killed by sun-scald or bruising.

Slimy soft rot progresses faster than neck rot, and is not accompanied by a gray mold and sclerotia as is neck rot. Neither does it progress uniformly downward destroying all scales as does neck rot, but usually follows certain scales all the way around.

Slimy soft rot occurs in all onion-growing districts in the United States, and is most common in onions harvested during warm, rainy seasons, or in onions sun-scalded during the curing process. It is also very common in Spanish onions. It is claimed by growers that yellow varieties are more susceptible than red. Careful handling to avoid sun-scald and bruising during the harvesting operation is of primary importance as a preventive measure.

In badly affected shipments, immediate drying of the stock will check the progress of the rot. This may be done by dumping the sacks at once and spreading the contents.

Ref. (67).

ONION SMUDGE.

ONION: SMUDGE.

Cause: A fungus (Colletotrichum circinans).

Smudge or anthracnose is a disease of white onions characterized by black blotches or aggregations of minute black dots on the outer scales. Each one of the minute dots is an acervulus (plural, acervuli). These acervuli are often arranged in concentric rings. In severe cases, the smudgy spots are so extensive that the side of the onion appears smoked. Generally the smudge is on the outside scales, though it may appear on the inner scales as well. It should not be confused with the black powder which is characteristic of black mold.

It is of widespread geographic distribution, but only white varieties are seriously affected. Infection takes place in the field from the fungus which overwinters in the soil. The disease appears shortly before the harvest, and develops rapidly in the crated onions after the harvest if the weather is moist. It causes very little shrinkage of affected bulbs. the chief damage being due to the appearance and reduced market value of affected bulbs.

Smudge can be prevented by rapid curing of the crop as soon as it is harvested. If the bulbs are stored in a dry place, the disease makes little progress. In a moist atmosphere, the fungus penetrates from scale to scale, and causes a softening of the tissues.

Ref. (72).

ONION

FREEZING INJURY

SMUT

ONION: SMUT.

Cause: A fungus (Urocystis cepulae).

Onion smut appears as dark-colored, slightly raised streaks or blisters on the bulbs and leaves. The leaves are often recurved and distorted. Sets may be greatly shrunken with the whole exterior covered with the blisters. When cut open, these ridges or pustules are found to be filled with a greenish black powdery mass. Smut differs from black mold in that the black powder is within the tissues of the scale, not upon or between the scales.

Onion smut is common in northern growing regions, especially in Wisconsin, Illinois, New York, Ohio, Iowa, and Massachusetts.

The fungus persists in the soil, and infection occurs when the plants are seedlings. Badly infected plants are usually killed and large losses are thus caused in the field. There is no progress of the disease in storage or transit. Smut is uncommon in the market except on onion sets.

Control measures are planting in clean soil or the use of a formaldehyde drip on the seed drill.

Ref. (71).

ONION BLUE MOLD
BLOTCH (BELOW)

ONION: MISCELLANEOUS DISEASES.

BLOTCH.

Cause: A fungus (Macrosporium).

The name "blotch" has been temporarily adopted for this blemish on the outer scales of red and yellow varieties of onions. The symptoms are large bleached or greenish discolored areas on the bulbs, bearing numerous fine black linear marks or ridges parallel to the veins.

BLUE MOLD.

Cause: A fungus (Penicillium).

Under certain conditions in storage or transit, blue mold occurs on the outside of the bulbs, and is usually associated with insufficient ventilation and some predisposing injury to the tissues, such as wounds, freezing, or sun-scald.

While most fruits are subject to attack by species of Penicillium, among vegetables, only onions, sweet potatoes and sweet corn are commonly attacked.

FUSARIUM ROT.

Cause: A fungus (Fusarium).

This rot usually but not always proceeds from the base of the bulb. The affected region is soft and flabby and becomes shrunken and shriveled in appearance. The surface may be studded with small white pads, the fruiting bodies of the causal fungus. There is no development of gray mold or black sclerotia as in neck rot.

GRAY MOLD SPOT.

Cause: A fungus (Botrytis).

This disease causes a bright red lesion on the neck at the ground line, which results in the death of the outer leaf. At times a slight outgrowth of gray mold may be formed in the lighter colored center of the lesion. Gray mold spot is found only on winter-grown green onions in the spring, and has been noted in the Kansas City market gardens.

SUN-SCALD.

(See Sun-Scald).

PARSNIP: GRAY MOLD ROT; BOTRYTIS ROT.

(See Gray Mold Rot).

PARSNIP: WATERY SOFT ROT; SCLEROTINIA ROT.

(See Watery Soft Rot).

PEA BACTERIAL SPOT

PEA: BACTERIAL SPOT.

Cause: Bacteria.

On the pods this disease appears as greasy water-soaked spots which may enlarge to irregularly circular, slightly sunken watersoaked blotches with gray centers.

This is a rather widespread disease of the vines, and pod infection occurs in the field. It seems likely that the spots enlarge during transit. Bacterial spot was found commonly in the Chicago market in the summer of 1918, and appeared to predispose the stock to secondary rots.

No control is known at present.

PEA POD SPOT.

PEA: POD SPOT.

Cause: A fungus (Ascochyta pisi).

The symptoms of this disease are rather small, definitely circular and sharply depressed spots with tan-colored or pinkish centers often bearing small pimples, the pycnidia of the fungus.

This is a serious field disease affecting the leaves and stems as well as the pods. Pod infection occurs in the field, and there is probably little spread of the disease during transit.

Control involves crop rotation and the use of disease-free seed.

Ref. (73).

PEA WATERY SOFT ROT.

PEA: SLIMY SOFT ROT; BACTERIAL ROT.

(See Slimy Soft Rot).

PEA: WATERY SOFT ROT; SCLEROTINIA ROT.

(See Watery Soft Rot).

PEPPER RHIZOPUS ROT.

PEPPER: ANTHRACNOSE.

Cause: A fungus (Gloeosporium).

Slate-colored to charry black, sunken lesions are characteristic of this disease. The margins of the lesions either are darker colored or watersoaked but of the same color as the healthy tissue, and wrinkled. Under moist conditions salmon-colored dots or spore heaps occur, which may run together and form a slimy mass. These dots are the acervuli (sing. acervulus) of the fungus and furnish a positive diagnostic character for this disease.

This disease is found frequently on peppers. Very frequently, under market conditions, the lesions do not bear acervuli but become covered with a black, velvety growth of Alternaria species.

PEPPER: RHIZOPUS ROT.

(See Rhizopus Rot).

PEPPER: SLIMY SOFT ROT; BACTERIAL ROT.

(See Slimy Soft Rot).

PEPPER: WATERY SOFT ROT; SCLEROTINIA ROT.

(See Watery Soft Rot).

PEPPER: SUN-SCALD.

(See Sun-Scald).

POTATO RUSSET SCAB
BLACK SCURF (BELOW)

POTATO: BLACK SCURF AND RUSSET SCAB.

Cause: A fungus (Rhizoctonia).

Black scurf and russet scab are skin diseases. Affected potatoes are rough and dirty in appearance, or may have a cracked or corroded skin. Both are field diseases caused by the same fungus.

Black scurf is characterized by the presence of small brown or black masses or sclerotia on the tuber, often referred to as "dirt which will not rub off." These masses may be circular or irregular in outline and single or joined into series. Washing the tuber brings these into sharp relief.

Russet scab is a corrosion of the tuber skin. In some cases smooth-skinned tubers show local or general netting, either slight, or so extensive as to resemble the skin of netted varieties. In advanced stages the corrosion becomes channeled, and the intersecting channels may become so deep that the tuber surface suggests alligator hide.

In many cases, tubers are literally covered with black scurf without any apparent russeting, while in other cases the presence of the fungus seems to cause only a cracking or scabbing, without any sclerotia.

Generally neither black scurf nor russet scab are serious enough to affect the market value of potatoes. The former occasionally is severe enough to affect the appearance of the tuber. At times, in very moist cars or storage places, the sclerotia germinate, and the potatoes become covered with a luxuriant growth of mold which detracts from the good appearance of the lot. Russet scab, however, affects the appearance of the tuber more markedly, and often corrodes the skin suffciently to necessitate deep paring, which is attended by a waste of food.

Ref. (50); (64).

POTATO: SILVER SCURF.

Cause: A fungus (Spondylocladium atrovirens).

Silver scurf is a skin disease which is purely superficial, and does not penetrate below the cork layer. The infected areas are marked by their silvery appearance, which is especially pronounced if the tubers are washed. In late stages of the disease, the affected skin becomes wrinkled and sloughs off.

Generally, affected areas occur near the stem end, but they may be found over the entire surface. Diseased areas vary from one-fourth inch to one inch or more in diameter.

In storage, especially under moist conditions, a sooty layer composed of the spores of the fungus may be found on the diseased areas.

Infected stock is fit for table use.

Ref. (43); (57).

POTATO: WART.

Cause: A fungus (Chrysophlyctis endobiotica).

In its early stages, wart is characterized by small, warty outgrowths which usually occur at the eyes of the tuber. These warts later become very large, and in severe cases, cover or involve the entire tuber. They are rough and black in color.

This disease is serious in certain parts of Europe, and has recently made its appearance in the United States (Pennsylvania). It is a very destructive field disease, and may be carried with diseased seed tubers. Once having gained a foothold, the fungus persists for long periods in the soil.

Infection takes place in the field while the tubers are growing. The disease does not progress in storage, and does not spread to healthy tubers. Diseased stock is very subject to secondary rots, and in this way it is a menace to healthy stock. Slightly affected tubers may be used for table purposes.

Precaution against the use of diseased tubers for seed purposes is of prime importance in the prevention of this disease. With this end in view a National quarantine has been established.

Ref. (35); (63).

POTATO: COMMON SCAB
AND DEEP SCAB (BELOW)

POTATO: COMMON SCAB.

Cause: A fungus (Actinomyces scabies).

Scab is characterized by rough corky elevations, or by pits. If tubers are attacked early, the pits are deep; if late, they may be shallow and superficial. In the early stages, affected tubers are marked with minute, reddish or brownish surface lesions. Cork formation usually occurs underneath these lesions. Often the lesions coalesce and in severe cases the entire tuber may be covered by a rough incrustation. Scabby potatoes are little if any more disposed to decay than clean potatoes.

Deep scab is an advanced stage of common scab. Often insects or mites live in scab pockets. It is not known to just what extent these are responsible for the lesions.

Common scab occurs in all varieties of potatoes and is most common in potatoes grown in alkaline soil. Treatment of seed stock with corrosive sublimate, and planting in uninfected soil or acid soil are fair preventives of the trouble.

Wireworm or grub injury often are confused with scab lesions. It frequently is difficult to differentiate between them. Wireworm injury is generally marked by extensive channeling in the tuber skin, while grub injury is marked by deep, broad pits with protruding or overhanging rims. Wireworm and grub injuries often are points of entry for Fusarium species.

Scab and insect injuries depreciate the value of tubers for table use by making them unsightly, and by necessitating deep paring with attendant loss of food.

Ref. (10); (38); (39); (50).

POTATO: POWDERY SCAB.

Cause: A slime mold (Spongospora subterranea).

In the early stages powdery scab consists of pimple or blister-like eruptions, one-sixteenth to one-quarter inch in diameter, which are completely covered by the skin of the tuber. Later these coverings rupture and expose pits, which are single or joined, and fringed by the flaring, papery, torn, and more or less toothed remnants of the skin. The interior of these pits is at first filled with a brown powder or dust, which is usually absent when the tubers reach market. Often the tissues surrounding the pits become discolored and sunken, and each pit or group of pits appears as a crater in a sunken zone.

Powdery scab differs from common scab in the more nearly circular lesions, smaller pits, presence of brown dust, star-like rupture of the skin, and relative absence of cork formation.

This disease is not as serious a menace as it was once thought to be. It seems to be localized in a few sections of North America, and is causing little damage. It is favored by cool, moist weather.

The causal organism is introduced into the soil with diseased seed stock, and tuber infection occurs in the field.

Affected stock is fit for table use. Its market value, however, is decreased because of its unsightliness, and because of the waste due to deep paring.

Ref. (44); (46).

POTATO LATE BLIGHT TUBER ROT.

POTATO: LATE BLIGHT TUBER ROT.

Cause: A fungus (Phytophthora infestans).

Late blight tuber rot is characterized externally by depressed, discolored areas of irregular but definite outline. These may occur merely as spots or as very extensive lesions. The affected areas often have a metallic or purplish tinge which is especially marked at the margin where the diseased tissue joins the healthy. At times, a pinkish color is apparent when the outer skin of affected areas is first removed. The diseased tissues underlying the sunken areas are browned, and unless secondary rots have set in, are quite dry and firm. The tissue is merely killed, not disintegrated. In cross section it is seen that the affected tissue tends to be limited to the outer parts of the tuber, and that the advancing edge is irregular and feathery.

Under storage conditions, especially if the air is very moist, secondary rots due to bacteria or fungi set in. At times, in advanced cases, it is difficult to ascertain whether the primary cause of rotting was freezing injury, with subsequent bacterial and fungous infection, or late blight. In such cases the deciding factors are the presence in the shipment of clear-cut cases of late blight or of freezing injury.

Potatoes affected with late blight do not show the hollow brittle regions found in potatoes affected with Fusarium tuber rot, nor the shriveled and wrinkled surfaces caused by Fusarium or freezing injury. The feathery edge of the tissue killed by the late blight fungus also serves to differentiate it from tissues killed by Fusarium or freezing.

Late blight tuber rot occurs most commonly in potatoes grown in the Eastern and North Central States, and in the coastal portions of the Pacific Northwest States. Under certain weather conditions, it also occurs in southern potatoes. During the rainy season of 1918, late blight was prevalent in Florida potatoes. It is not a hot weather disease but is favored by cool, wet weather.

Late blight is one of the most important field diseases of the potato, causing a severe blight of the vines in addition to its attack on the tubers.

The fungus overwinters in diseased tubers, and is introduced into the field with diseased seed stock. From diseased seedlings produced by such seed, the fungus spreads rapidly throughout the field when weather conditions are favorable. Tubers are infected in the field by spores washed down or spattered from the diseased vines. The disease also develops in transit and storage.

Late blight can be controlled in the field by spraying with Bordeaux mixture. Its development in transit and storage is checked by a dry atmosphere and a low temperature (34° to 36° F.; 45° F. is too warm). It is highly desirable that diseased tubers be sorted out as soon as they can be de-

POTATO LATE BLIGHT TUBER ROT.

tected. In case of a late blight epidemic, digging should be postponed until the tops have dried up.

Affected tubers are not marketable for table use. They are also a menace to sound stock in transit and storage since secondary rots, such as Fusarium or slimy soft rot, very frequently follow late blight.

Ref. (9); (18); (34); (45).

POTATO FUSARIUM TUBER ROT.

POTATO FUSARIUM TUBER ROT

POTATO: FUSARIUM TUBER ROT.

Cause: Fungi (Fusarium species).

Fusarium tuber rot is generally marked by sunken, shriveled, wrinkled, or broken areas on the tuber surface. These areas may be brown to black in color and on them may appear masses of whitish or brightly colored mold.

The diseased tissue underlying such discolored and shrunken areas may be dry and brittle, and may contain cavities lined with a white or bright colored growth of the fungus responsible for the rot; or this tissue may be watery but intact, depending upon the species of fungus responsible for the rot and the conditions under which the affected tuber was kept. Usually, if affected tubers are kept in a dry cool place, the dry, brittle, and hollow type of powdery dry rot results. If they are kept in a warm moist place the soft intact type of rot is usually the result. Affected tissue may be gray or brown to black in color.

The rot may proceed from the stem or seed end, from the eyes or from broken places in the skin, such as cuts and bruises. At times the infection is confined to a mere discoloration of the vascular ring proceeding from the stem end of the tuber. This is not visible until the tuber is cut. This discoloration cannot always be positively differentiated, without miscroscopic examination and cultural test, from discolorations due to freezing injury or to varietal characteristics. Fusarium discoloration penetrates much farther into the tuber, however, than other vascular discoloration. In southern potatoes, this discoloration in the ring can be told from a similar discoloration due to brown rot by the absence of the slimy bacterial masses or droplets which ooze out when tubers affected with brown rot are cut.

This stem-end infection and some lenticel and eye infections occur in the field. Stem-end invasion is very common in potatoes produced by plants affected with Fusarium wilt. Jelly-end is another type of stem-end infection which occurs in the field. However, most of the tubers rotted by Fusarium species are infected through breaks in the skin caused during and after the harvest.

Tubers with areas injured or killed by freezing are very subject to Fusarium rots. The rot usually starts in at some point which did not heal over completely with cork or was not entirely sealed with starch following the drying out of the frozen tissue. At times it is very difficult to distinguish between potatoes with frozen areas which were subsequently infected with Fusarium tuber rot, and potatoes which were originally affected with the rot and then kept under moist conditions. The end result in both cases is usually a wet brown rot. This wet type of rot is especially marked in the Burbank and Netted Gem potatoes from Idaho. It may be practically impossible at times to determine the cause of the decay by examination of a single tuber

FOLLOWING FIELD FREEZING INJURY

POTATO FUSARIUM TUBER ROT (WET TYPE)

without a microscopic examination or cultural test. An examination of the entire lot, however, will reveal the presence or absence of typical signs of freezing injury. The frozen tissue of a tuber usually is set off from the healthy tissue by a more or less straight purple or brown line which extends across all the tissues of the tuber, or by a gray, chalky, brittle layer of starch. On the other hand, most Fusarium species generally tend to rot the center of the tuber faster than the cortical tissue, leaving a shell of sound tissue enclosing a rotted center.

An examination of the surface of a tuber may not be sufficient to determine whether the tuber is affected with late blight or Fusarium tuber rot. Both produce sunken discolored areas. The late blight tuber rot, however, causes more of a metallic luster than the Fusarium tuber rot, and usually the sunken area is not shrunken and shriveled. In tubers affected with late blight, the diseased tissues underlying the discolored areas are solid and dry and have a feathery edge, while in the Fusarium tuber rot the diseased tissue, if dry, contains cavities or is watery and soft and in cross-section is set off from healthy tissue by a sharp, smooth edge.

Tubers affected with the soft, wet, brown type of Fusarium tuber rot can be differentiated from tubers affected with the slimy soft rot by the absence of the foul odor so characteristic of all bacterial soft rots. Fusarium-infected tissue is not slimy even though it is soft and disintegrated.

Deterioration of tubers due to Fusarium tuber rot is sometimes rapid and often complete. Infected tubers are a menace to healthy ones. Immature tubers, cut and bruised tubers, tubers with second growth knobs which are easily broken off, tubers affected with other diseases such as late blight tuber rot or blackleg, and tubers with frozen areas are an easy prey for the Fusarium species causing tuber rot.

One or more forms of Fusarium tuber rot occur in practically all potato districts. Fusarium tuber rot is much more common in northern than in southern potatoes. It does develop, however, in southern potatoes shipped north and causes a very soft, watery rot or a stem-end rot. The original infection may occur in the field, in transit or in storage, but in most cases the rot develops and spreads in transit and storage. In a few cases, such as jelly-end rot and black field rot, the disease develops in the field.

The Fusarium tuber rot in potatoes from the Central Western States, especially in the Early Ohio stock from Nebraska and Minnesota, and the Burbank and Netted Gem stock from Idaho, is called powdery dry rot. This term refers more to the appearance of the spore masses of the fungus than to the diseased tuber tissues. The Fusarium tuber rot in potatoes from the Eastern States is designated as tuber rot or dry rot and generally is of the wet type. The

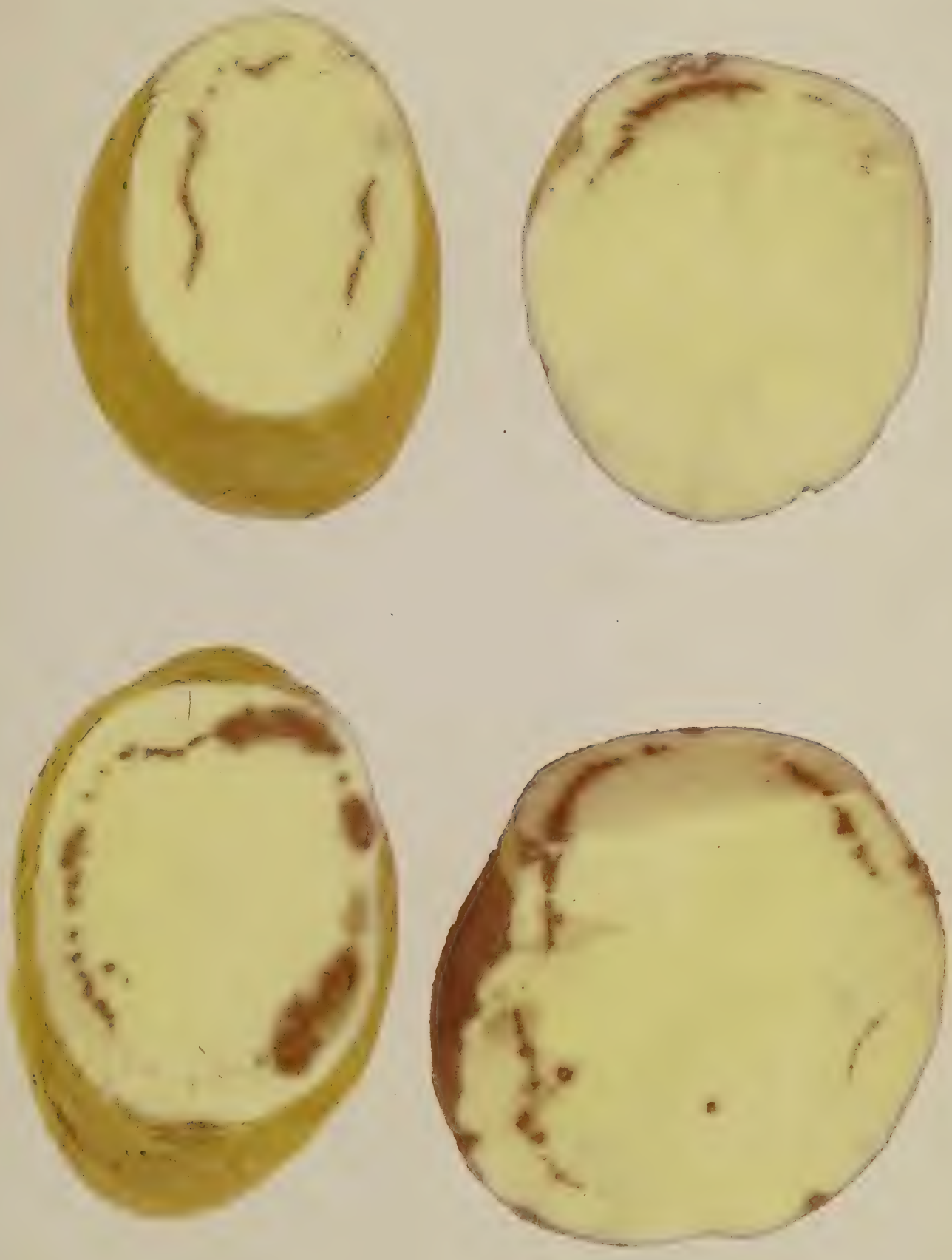
POTATO FUSARIUM TUBER ROT FOLLOWING LATE BLIGHT TUBER ROT.

Fusarium tuber rot appearing at the end of the tuber in the long, white varieties of the Northwest, such as the Burbank, is known as jelly-end, while that appearing in other parts of the tuber, especially marked in the round varieties such as the Rural, is known as "black field rot." These rots are caused by Fusarium radicicola, which also causes a very soft leaky rot and a dry, black stem-end rot of potatoes grown in the southern half of the Mississippi Valley.

Wounded or bruised surfaces which have become sealed with starch or cork should not be confused with Fusarium infections. Generally tuber rot starts in bruises and cuts. During the early storage season, it is often impossible to determine whether or not a bruise or cut will develop tuber rot. Later in the season the presence of soft discolored tissue or cavities lined with mycelium makes a diagnosis much easier.

The safest and surest methods of control are careful handling of tubers to avoid cutting and bruising; sorting out of bruised, broken, cut, diseased, and frozen potatoes; and storing of tubers in a well-ventilated place at a temperature between 36° and 40° F.

Ref. (7); (37).



POTATO FUSARIUM WILT

POTATO FUSARIUM TUBER ROT (JELLY END ROT)

POTATO: JELLY END ROT; BLACK FIELD ROT.

Cause: A fungus (Fusarium radicicola).

Both jelly end and black field rot are types of the Fusarium tuber rot previously described. In jelly end rot, the end of the tuber is shrunken and collapsed, while black field rot is characterized by shrunken, collapsed, black to brown areas occurring anywhere on the surface of the tuber.

The diseased tissue underlying the discolored or shrunken surface is soft, watery, and light to dark brown or black in color, or it may be rather firm and black. Unlike powdery dry rot, cavities generally do not occur in the affected tissues.

The moist condition of jelly end rot is not observed unless the potatoes have just been dug or have been removed recently from a car which sweated or became overheated in transit. Generally, under market conditions, the disintegrated tissue dries out and resembles typical dry rot. Very often stock affected initially with jelly end or black field rot subsequently becomes affected with powdery dry rot, which progresses rapidly in storage.

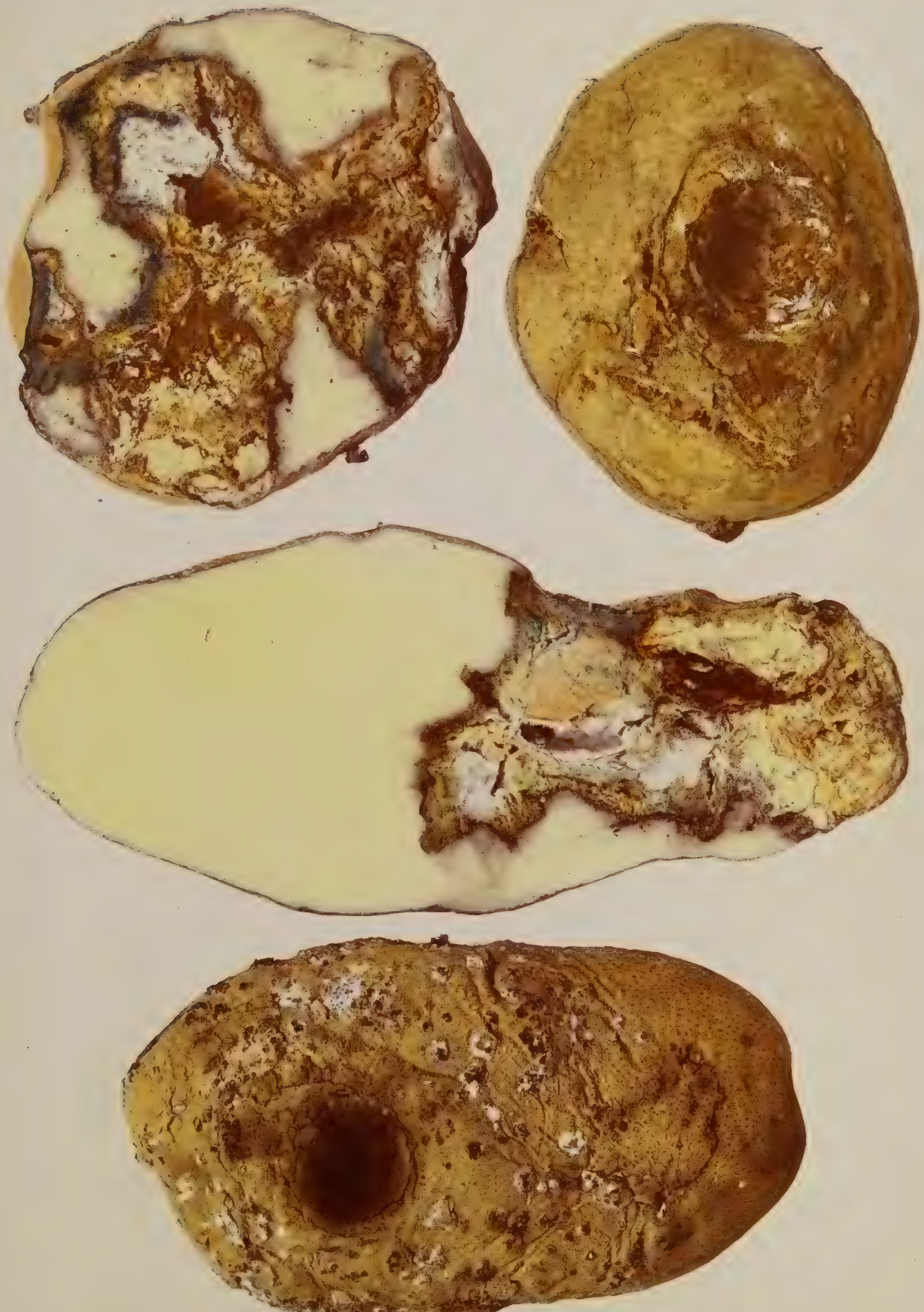
These rots occur most commonly in Nebraska, Idaho, and Pacific Coast potatoes. Jelly end rot is prevalent in the long varieties such as the Burkbank type, while black field rot is most clearly marked in the round varieties such as the Rural. Without a cultural examination it is impossible to differentiate at times between jelly end rot and so-called dry rot of the end of the tuber caused by Fusarium species other than Fusarium radicicola.

The original infection takes place in the field. Both diseases develop in the field. They probably do not develop or spread in transit and storage, but do open the way for other Fusarium tuber rots.

Fusarium radicicola may cause in southern potatoes a very watery leaky rot which involves the entire tuber and resembles the watery soft rot of other vegetables caused by Sclerotinia. This rot differs from jelly end and black rot in that the whole tuber is affected and that the rot is watery rather than jelly-like or firm. The diseased tissue is only slightly discolored. Under certain conditions in transit, an extensive mycelial growth and numerous bodies which resemble small sclerotia develop on the surfaces of affected tubers.

In this leaky rot of southern-grown potatoes caused by Fusarium radicicola, the original infection takes place in the field. This type of rot is favored by hot weather, and is very frequently associated with scald. It is probable that this disease, unlike jelly end or black field rot, develops and spreads rapidly in transit.

Ref. (7); (54).



POTATO FUSARIUM TUBER ROT (POWDERY DRY ROT TYPE)

POTATO: POWDERY DRY ROT.

Cause: A fungus (Fusarium trichothecioides).

Powdery dry rot is a type of the Fusarium tuber rot previously discussed. In the name powdery dry rot, the word powdery does not refer to the appearance of the diseased tissue but to the powdery masses of spores formed by this fungus.

In this disease the affected region contains cavities separated by dried brownish tissue and starch and lined with whitish fluffy mycelium or powdery pink masses of spores. In the early stages, the affected tissue is light brown to black in color and is sharply delimited from the healthy tissue by a layer of brown or black tissue. Affected tubers are much lighter in weight than healthy tubers because of the extensive hollow areas. This rot is most pronounced in the central portion of the tuber, and as a result, affected tubers often become more or less hollow shells.

If tubers infected with powdery dry rot are stored in a very moist atmosphere, or if they become infected with bacteria, the typical symptoms are partly masked by the presence of soft watery tissues of chocolate color, which generally are more extensive than the typical dry areas.

Potatoes just taken from a car which has been in transit a long time, or which was not cooled or ventilated properly, show the symptoms of wet Fusarium rot rather than the symptoms of powdery dry rot. However, upon exposure to the air the typical dry rot symptoms soon develop.

Powdery dry rot appears to progress more rapidly at lower temperatures than the other Fusarium tuber rots. It occurs mainly in Idaho and other Rocky Mountain districts, and in western Nebraska, being especially severe in the Early Ohio variety. It is prevalent in bruised or frozen potatoes from Washington, Idaho, Nebraska and Colorado.

Infection takes place through breaks in the skin of the tuber. These may be brought about by cuts or bruises, by freezing and by attacks of other fungi. The spores of Fusarium are usually everywhere present in the soil, on the surfaces of tubers, and in storage places, so that any break in the tuber skin is very likely to become infected.

Control of this disease depends upon careful handling of potatoes to minimize injury as far as possible. Because of the rapid progress of the rot, it is advisable to dispose of affected stock at the earliest opportunity. It is not profitable to ship severely affected stock.

Ref. (37); (53).

POTATO LEAK

POTATO: LEAK.

Cause: Fungi (Pythium debaryanum; sometimes Rhizopus nigricans).

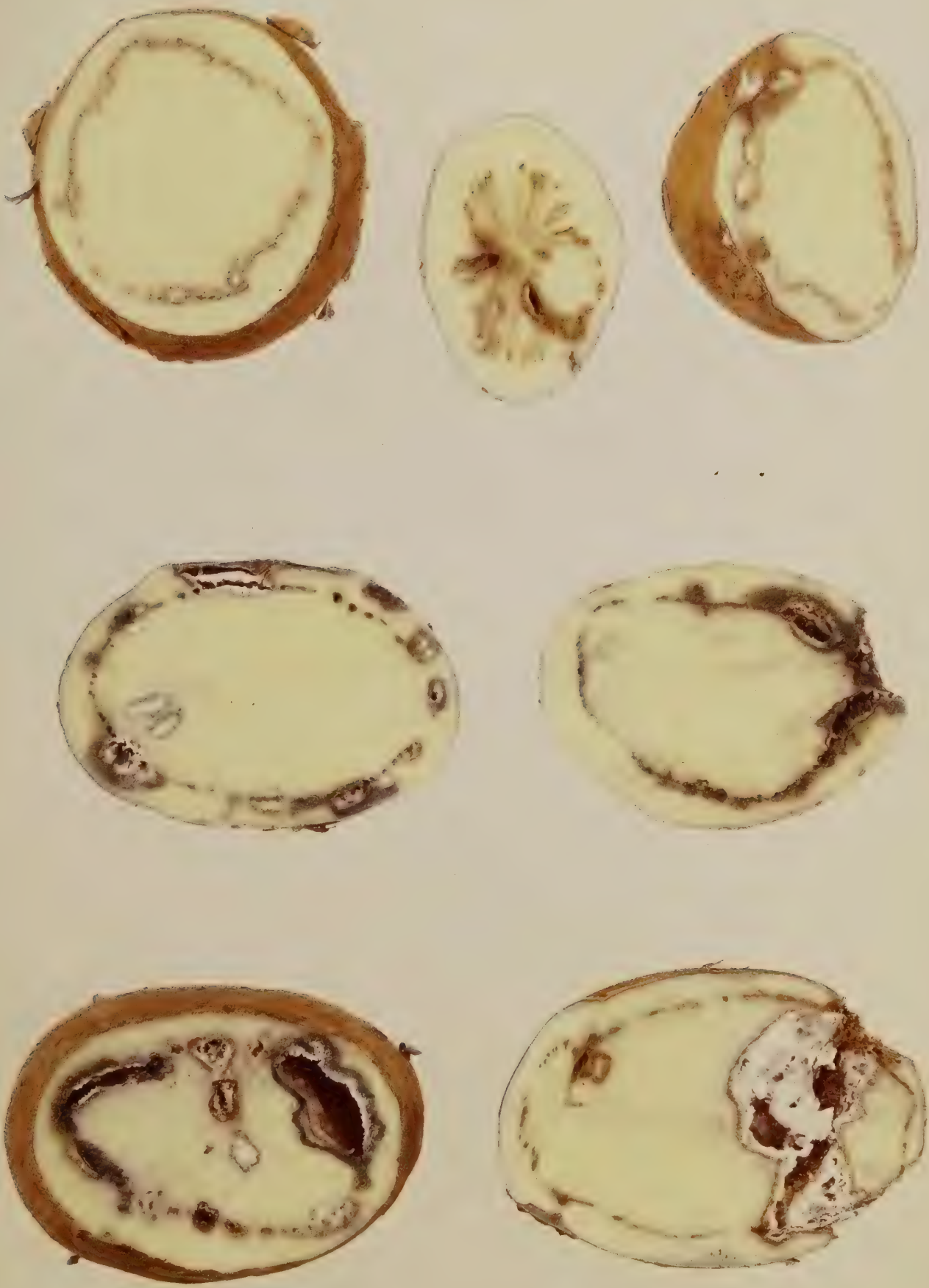
Leak is marked at first by a brown discoloration around wounds or bruised areas. The discoloration later becomes extensive, and the entire interior of the potato may become soft, and buff or light brown in color. Under pressure, the affected tubers exude a brownish watery liquid, and diseased tubers often leak badly. Potatoes affected with leak are much more watery than those affected with the wet type of Fusarium tuber rot.

Leak has been reported only from the Delta lands of the San Joaquin Valley of California and from Idaho. It does not occur in cool weather, and is entirely checked by heavy frosts.

Infection takes place in the field, and tubers are infected only through wounds, such as those due to fork injury or the breaking off of second-growth knobs. Infection occurs only in hot weather, but once the disease has gained a foothold, it may devevlop at lower temperatures.

Leak can be controlled by careful digging and handling of the potatoes and sorting out of bruised and broken tubers. In addition it has been found advisable to hold suspected potatoes 4 days in the warehouse before shipment so that the disease, if present, may develop and be more readily detected. It is not likely to be a storage trouble after the warm season.

Ref. (28); (29).



POTATO BROWN ROT.

POTATO: BROWN ROT (SOUTHERN BACTERIAL WILT).

Cause: Bacteria (Bacillus solanacearum).

Brown rot may be indicated externally by a slight depression at the point of attachment of the stolon to the tuber, or by gray discolored patches on the surface. Sometimes no external symptoms may be visible. Upon cutting infected tubers, a moist brown discoloration and slight softening of the ring (vascular) tissue of the tuber is seen. White sticky globules of bacteria ooze out from the cut tissues. In this stage, the rot is odorless.

The rot begins in the vascular ring, causing cavities which are filled with a dirty white, slimy, bacterial mass. Brown rot may be followed by slimy soft rot to which the foul odor of affected tubers is due.

This rot should not be confused with the ring discoloration associated with Fusarium wilt. The latter is most common in northern potatoes, while brown rot occurs only in southern, especially Florida, stock. There is no bacterial exudate from the bundles when a Fusarium infected tuber is cut.

Infection takes place in the field and the disease is there known as bacterial wilt. The infection proceeds from the affected plant through the horizontal underground stems (stolons) into the tubers which are enlargements of the stolons. Potatoes grown in new soil are most severely affected.

It is advisable not to plant potatoes in new ground. Infected stock is subject to decay and should be rapidly disposed of.

Ref. (61).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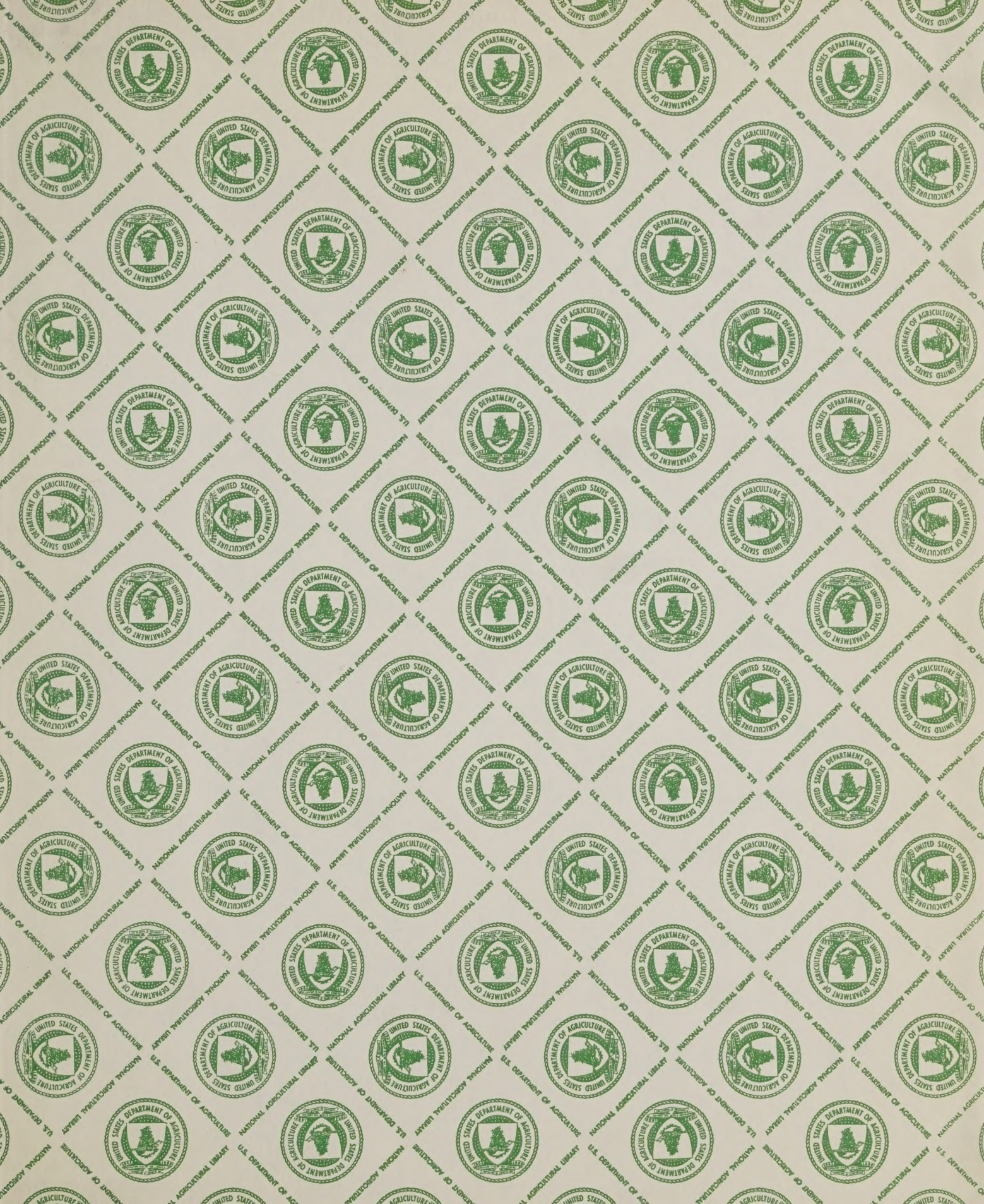
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